

**CLAIMS****What is claimed is:**

1. A pharmaceutical composition for regulating the cholinergic phenotype of neurons said composition comprising an effective amount of a BMP-9 protein in a pharmaceutically acceptable vehicle.
2. A pharmaceutical composition for differentiating cholinergic neurons, said components comprising an effective amount of BMP-9 in a pharmaceutically acceptable vehicle.
3. A pharmaceutical composition for treating degenerating cholinergic neurons said composition comprising an effective amount of a BMP-9 protein in a pharmaceutically acceptable vehicle.
4. A pharmaceutical composition for treatment of Alzheimer's comprising an effective amount of the composition of claim 3.
5. A pharmaceutical composition upregulating the genes for choline acetyltransferase said composition comprising an effective amount of the composition of claim 1.
6. A pharmaceutical composition for upregulating the genes for vesicular acetylcholine transporter said composition comprising an effective amount of the composition of claim 1.

7. A method for differentiating cholinergic neurons in a patient in need of same comprising administering to said patient an effective amount of the composition of claim 4.
8. A method for treating Alzheimer's in a patient in need of same comprising:
  - 5 a) applying a BMP-9 composition of claim 4 to embryonic basal forebrain cells to differentiate cholinergic neurons in vitro; and
  - b) transplanting said treated cells in said patient.
9. A method for treating degenerating and/or malfunctioning cholinergic neurons in a patient in need of same comprising administering to said patient an effective amount of the composition of claim 3.
10. A method for treating degenerating and/or malfunctioning cholinergic neurons in a patient in need of same comprising the steps of:
  - 15 a) treating embryonic basal forebrain cells in vitro with BMP-9 to generate cholinergic neurons; and
  - b) transplanting said treated cells in said patient.
11. A method for upregulating the genes for choline acetyltransferase in a patient in need of same administering a composition of claim 5 to said patient.
12. A method for upregulating vesicular acetylcholine transporter in a patient in need of same comprising administering a composition of claim 6 to said patient.

13. A method for the differentiation and/or maintenance of cholinergic neurons in a patient in need of same comprising :
  - a) transfecting cells with a vector comprising a nucleotide sequence encoding BMP-9; and
  - 5 b) implanting said transfected cells in said patient.
14. A method for treating degenerating motor neurons in a patient in need of same comprising administering to said patient an effective amount of a BMP-9 composition.
- 10 15. A pharmaceutical composition for regulating the cholinergic phenotype of neurons said composition comprising an effective amount of a BMP selected from the group consisting of BMP-2, BMP-4, BMP-6, BMP-7 and BMP-12.
- 15 16. A pharmaceutical composition upregulating the genes for choline acetyltransferase said composition comprising an effective amount of the composition of claim 15.